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On motion, the Secretaries were instructed to return the same to the author as undesirable for publication by the Society.

Dr. Cope presented for the Proceedings a paper by Prof. Jesse W. Hubbard, entitled, "The Yolk Nucleus in *Cymatogaster aggregatus*."

Dr. Cope made some remarks upon the results of late explorations by Mr. Henry C. Mercer, of the Durham Cave of Bucks county, Pa., near Easton, and of Hartman's cave, Monroe county, Pa., near Stroudsburg.

Dr. Brinton spoke of the negative results from the researches heretofore made by Mr. Mercer in American caves, as furnishing no evidence of the existence of a race prior to the Indian inhabitants of this continent.

After all the other business of the meeting was ended, the ballots cast were counted by the Tellers, who reported to the President that the formalities necessary for election to membership had not been fulfilled in the present instance.

And the Society was adjourned by the President.

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*Obituary Notice of Joseph Zentmayer.\**

*By Charles A. Oliver, M.D.*

*(Read before the American Philosophical Society, December 15, 1893.)*

"Two things," says Kant, "fill me with awe, the starry heavens and the sense of moral responsibility in man," but how insignificant are these wonderful words to that marvelous expression,

"Whene'er a noble deed is wrought,  
Whene'er is spoken a noble thought,  
Our hearts in glad surprise  
To higher levels rise. . . ."

of one of America's greatest teachers of poetical truth. So here, when it becomes the duty of one to give the life history of another greater than

\*The writer is under obligations to Prof. Ryder and many others for the facts and dates herein given.

himself, and to tell that story truthfully to those who have better and greater understanding of the details of that life's work than himself, the task becomes not only necessarily difficult, but doubly a happiness. So to the present memoirist, although knowing the subject of this sketch most intimately in his chosen pursuit, yet he feels a deep sense of duty and doubt in action when confronted with an undertaking which he can do no less than denominate as a labor of love.

His first meeting with Mr. Zentmayer was some thirteen years ago, when he found himself ushered into a most curious little workshop on Fourth street above Walnut street, replete with all manner of cumbersome, peculiarly shaped and intricate devices in what seemed old steel and dirty brass; from the midst of which, the plain though truly honest face of Teutonic type welcomed him with a cheery "Good-morning!"

From that first acquaintanceship, the most revered and kindly friendship existed; a friendship which was only severed and broken upon the day that word came that he was no more—the day when the first knowledge of the loosening of the silver cord and the breaking of the golden bowl that bound and held him with us, was made known.

He left us, not for evermore, but passed from us filled with Beethoven's hope, as he, too, was about to tread into that great unknown way.

"Brüder, über im Sternenzelt  
Muss ein lieber Vater wohnen."

Joseph Zentmayer first saw the light of day in Manheim, Baden, on the 27th day of March, 1826. After the completion of his studies in the town gymnasium, he found himself for the first time ushered into that work to which he was destined to contribute so much that is good and so much that is useful. After faithfully serving his apprenticeship with the optician of his native place, and obtaining the foundation of the knowledge and skill which has marked him as a correct analyzer and a wonderfully ingenious contriver of mathematical and optical instrumentation, he further increased his power of observation and improved his technique by associating himself with some of the principal optical establishments in Karlsruhe, Frankfort, Munich and Hamburg. At the last named place, he was under the tutelage of the world-famous Repsold brothers, and there received advantages which he put to account in the later construction of astronomical apparatus.

The rapidity of strength of his character, and the early maturity of his love for individual independence and national liberty made themselves the keys by which the recesses of his future life were opened. Republican in spirit, he actively vouchsafed his nation's unsuccessful stroke for freedom when he was about twenty-two years of age, thus bringing him into this country in the year 1848. For five years he nobly fought his battle of wage-earning in some of the best optical establishments in Baltimore, Washington and Philadelphia, until in 1853, with a single foot-lathe, a stout heart, willing hands, and a steadfast purpose, he began the manu-

facture of mathematical and optical instruments at the corner of Eighth and Chestnut streets.

One of his earliest orders was the construction of a large compound microscope for the late Dr. Paul B. Goddard. The excellence of the instrument and his continually increasing local reputation amongst the prominent scientific men soon secured him the patronage of many of the leading histologists, microscopists and mineralogists. These business connections soon brought with them the pleasant and ever-extending social and scientific associations, so common and so universal amongst those whose life aims are for intellectual good and philosophical research. Although reticent to a degree and unassuming amongst large bodies of men, yet his uncompromising honesty of opinion when sought for, his constant willingness to help solve the most difficult problems in theoretical and applied optics, and the clear, forcible and logical manner with which he grasped and handled any subject in question, made men seekers of him rather than he of them.

Ever thus he was surrounded by distinguished men of all professions and occupations who were interested in microscopical and optical science ; men, who as friends and brothers, sought his workshop to take his counsel in the solution of vexed problems in the laws of light ; men, who as students came to him to gain his advice as to the best form of construction of instruments of precision ; and aye, even overwise tyros willingly found in this patient and unassuming man the calm and dignified correction that they had not supposed themselves able to receive.

Most approachable ; always cordial ; unbiased in his feelings towards the crudities of individual belief ; and unlimited in his liberality in regard to personal and national opinion, he embraced those qualities that make a man lovable, craved for, and sought after.

For nearly a quarter of a century he fought and rapidly subdued many of the vexatious questions in the construction of some of the most important mechanical details of the microscope, thus not only simplifying and perfecting the necessary apparatus, bringing greater ease, more comfort and superior results in technique to the practical microscopist, but obtaining those incentives and inducements for better and increased action. For these endeavors he received those official recognitions, by prize, medal, honorable mention and scientific distinction, that lead all honest and conscientious workers and observers to higher planes of employment.

As early as 1865 he received a diploma as an award for merit from the Massachusetts Charitable Mechanical Association, followed but nine years later by another from the Franklin Institute of this city. How much he was commended for in the receipt of the Elliott Cresson gold medal on the 18th of January, 1875, which was entrusted to the recommendation of the Franklin Institute of the State of Pennsylvania, by the provision of the founder's will, can only be guessed at by the following points of excellence—the marked superiority of general workmanship and finish ; the

improved plan of setting the binocular prism ; the introduction of a circular rotating and concentric stage ; the plan by which exact amplification of the image in the binocular instrument is obtained ; the invention of a direct vision-erecting prism ; the improved and perfect (mark the word "Perfect") mechanical finger ; the optical superiority of the lenses ("the lenses have no superiors"); and lastly, "for the erection and conduct of an optical establishment in our own city wherein work equaling the best done abroad is done on principles of honesty and thorough mechanical skill ; and all this as the result of one unaided individual." The Franklin Institute of the State of Pennsylvania also deemed it wise to give a silver medal for the same reasons. These all-sufficient reasons—which were the embodiment of the combined opinion of the Committee on Sciences and the Arts of the Franklin Institute, a committee composed of such representative men as B. Howard Rand, M.D., J. G. Hunt, M.D., George R. Morehouse, M.D., J. Solis Cohen, M.D., E. Otis Kendall, Charles M. Cresson, M.D., E. Thomson and H. C. Wood, Jr., most of whom as members of this Society are now with us in higher and more exalted positions—must bring vividly before us, in this later generation, the admiration and respect with which he was held at that time—a proof of scientific gratitude for individualized success, made still greater when it is known that its award was the second since its founding in the year 1848.

Listen to what the United States Centennial Commission for Awards at the International Exhibition held at Philadelphia in 1876 found sufficient reasons to offer a bronze medal for the microscope stands of Mr. Zentmayer : "For superiority of workmanship, rigidity and freedom from tremor, and the convenient arrangement of their moving parts as unsurpassed by any in use." "Besides the forms already familiar to microscopists, he has presented one which is substantially new, and which embodies a number of important improvements . . . this exceedingly ingenious stand is in every important respect original with the exhibitor, and is presented as a characteristically American stand." . . . "The objectives of 3-inch focus,  $1\frac{1}{2}$ -inch,  $\frac{8}{10}$ -inch,  $\frac{1}{2}$  inch,  $\frac{1}{4}$ -inch and  $\frac{1}{8}$ -inch are not surpassed in defining power by those of any other maker." "The resolving power of the  $\frac{1}{4}$  and  $\frac{1}{8}$ -inch is also remarkable." . . . "For a pocket microscope which folds up without separation of parts into a case, which when in use forms its stand, and is small enough to be carried without inconvenience in the coat pocket." "For an admirable dissecting microscope, furnished at a low price." "Further, of the numerous forms of apparatus accessory to microscopic observations, exhibited by Mr. Zentmayer, may be mentioned as especially worthy of commendation, a very ingenious erecting prism, a mechanical finger for picking up and arranging diatoms and other minute objects," etc.

To this stand he added a most important arrangement, without which no microscope can be considered complete. This consisted in a swinging substage, which, while carrying an achromatic condenser or illuminating apparatus, held a mirror which swung around a pivot placed behind the

stage, of which the axis passed through the object observed, so that the object is in the focus of the illumination in every position. This remarkably ingenious plan of swinging the substage and the mirror so as to have the object as its centre, induced numerous foreign and domestic makers to employ this important principle in optical construction.

Two years later, a third and most important honor was added to the list by the Committee of Awards on Microscopes at the Paris Exhibition, who found fit to give a silver medal and a diploma to Mr. Zentmayer for the superiority, manifold value and simplicity of his workmanship.

Recognizing the value and convenience of the Abbe system of condensing lenses or illuminator in stands that are provided with substages, he modified the ordinary form by so placing the carrier that the diaphragms can be readily changed and arranging the contrivance so that the diaphragm cannot only be moved over the field by rack and pinion, but that it can be revolved. How much we must praise his exquisitely simple, single-prism, total-reflecting camera lucida which is so contrived as to be used either in the upright, angular or horizontal positions of the draw-tube of the microscope.

How exasperatingly easy of comprehension and yet how excellently adapted for their purpose are his contrivances of the life-current and siphon-slides so arranged in accordance with Mr. S. D. Holman's ideas that varying degrees of circulation in animalculæ can be made visible, not only to the individual student at work with his highest powers, but actually made recognizable to large audiences during class-work instruction and lecture-room demonstration. Again, the wonderful mechanical construction of Prof. John A. Ryder's automatic microtome, where, with an ordinary razor, tissue-sections of .0025 mm. thickness can be cut by the merest novice, and objects to the length of fifteen centimetres and two centimetres wide can be completely cut serially into almost any desired thickness. Further, the botanical dissecting microscope designed and constructed to meet the requirements of Prof. J. T. Rothrock, of the University of Pennsylvania (a member of this Society), in his botanical class; his clinical stand for accurate examination of any object by a large class, by being passed from hand to hand, that the memoirist has so often used in his student-days; the cheapening and simplification of the microscope so as to bring a properly constructed and adequately working piece of apparatus into the hands of the student of limited means, thus allowing him to become an essential factor in scientific progress: these few contrivances are but a limited number of the mechanical triumphs that resulted from the employment of the never-ceaseless mind of Joseph Zentmayer (the optician), as he proudly styled himself, for more than a half century. Is it any wonder that we exclaim with Von Humboldt, "In the moral world there is nothing impossible, if we bring a thorough will to it. Man can do everything with himself."

An interesting incident in his life is the history of the patent of his doublet photographic lens, which is composed of two deep meniscus lenses

with their convex sides placed outwardly. He made the outer meniscus one-half larger than the back lens, thus allowing six different combinations with seven single lenses. Such a lens having an angle of nearly ninety degrees and great depth of focus, and giving extreme sharpness over the whole field, and being free from all distortion, necessarily became a most excellent instrument for architectural work and copying.

The story of the invention is this : One year before the patent of the lens was obtained, Mr. Coleman Sellers, who was at that time greatly interested in photography, requested Mr. Zentmayer to explain the theory of the then favorably known "Globe lens." Whilst examining a sample of the lens, Mr. Zentmayer remarked, "Why did the inventor adopt an achromatic combination, when the same or even better results could have been obtained by the combination of two simple meniscus lenses? Recognizing the force of the query, Mr. Sellers requested Mr. Zentmayer to experiment with a double lens. This having been successfully accomplished, he urged him to apply for a patent, which was reluctantly agreed to and done after the most earnest solicitation.

The introduction of this lens engendered a most spirited controversy as to question of the theory in optics involved in its construction. Prof. Henry Morton, Dallmeyer and other well-known authoritative scientists and experts, both here and abroad, took part in this discussion. Mr. Zentmayer's personal appearance in the matter, which showed itself in a short article entitled "Refraction without Dispersion and some Reflection," in the August, 1867, number of the *Philadelphia Photographer*, proved at once in a most forcible and logical manner that the writer was a consummate master in the field of theoretical and applied optics ; a paper that immediately established him as America's foremost optician.

One monograph, as further illustrating the remarkable clearness, ease of expression and fullness of comprehension with which he surrounded one of the most abstruse and most readily misunderstood of the theoretical and applied sciences—optics—is his illustrated brochure of twenty-three pages entitled "A Lecture on Lenses." This, which appeared in the May and June, 1876, numbers of the *Journal of the Franklin Institute*, is even now authoritatively recognized as one of the best, the most concise, and the clearest expositions of the subject that has ever been presented to the public.

Engaged as the official maker of the microscopes used in the hospitals of the United States Army ; appointed a member of the Iowa Total Eclipse Exhibition in 1869, to the success of which he contributed largely by the device of some of the most delicate of the photographic machinery ; a member of the Judge of Awards in the 1874 Fair of the Franklin Institute, the International Centennial Exhibition in 1876, and the Electrical Exhibition in 1885 ; a life-member of the German Hospital, and a member of the American Philosophical Society, the Academy of the Natural Sciences of Philadelphia, both the American and British Associations for the Advancement of Science, the Franklin Institute of Philadelphia, both

the American Society and the New York Society of Microscopists, the Biological and Microscopical Society of Philadelphia, the Philadelphia Photographic Society, the Young Mænnerchor, the Turn-Gemeinde, the Künstlerverein, we can well see that not only was his public work of the most varied character, the most useful to both his city and his country, and of the most value to science, but that his associations were the widest, the most congenial, and the most elevating in character.

Amongst his intimate German friends, his literary knowledge of the authors in his native tongue was well known. Ever a lover of Goethe and the cynical wit of a Heine; deep in the matchless guessings and wonderful intuition of a Von Humboldt, he lived with them the ideal life that always remain ideal to a kindred Teutonic mind.

How much we must praise him when in spite of the fact that he acquired our language (one of the most difficult) after he had gained his majority, he read and reread that never-to-be-repeated series of studies of the human passions by William Shakespeare, enjoyed the young passionate and conscienceless words and thoughts of Byron, laughed and sighed with Burns, walked with Dickens, and followed our own poet laureate, Longfellow.

These associations, as well as those higher correlated ones of music, painting and sculpture, formed both in public life by active membership in various local literary and physical-culture societies, and in the privacy of home with its small, though well-selected collection of works of arts, to which he brought many of his literary and artistic friends, evidence not only his exceptional taste in these the pleasures of higher mental life, but exhibit his acumen and critical judgment in their enjoyment.

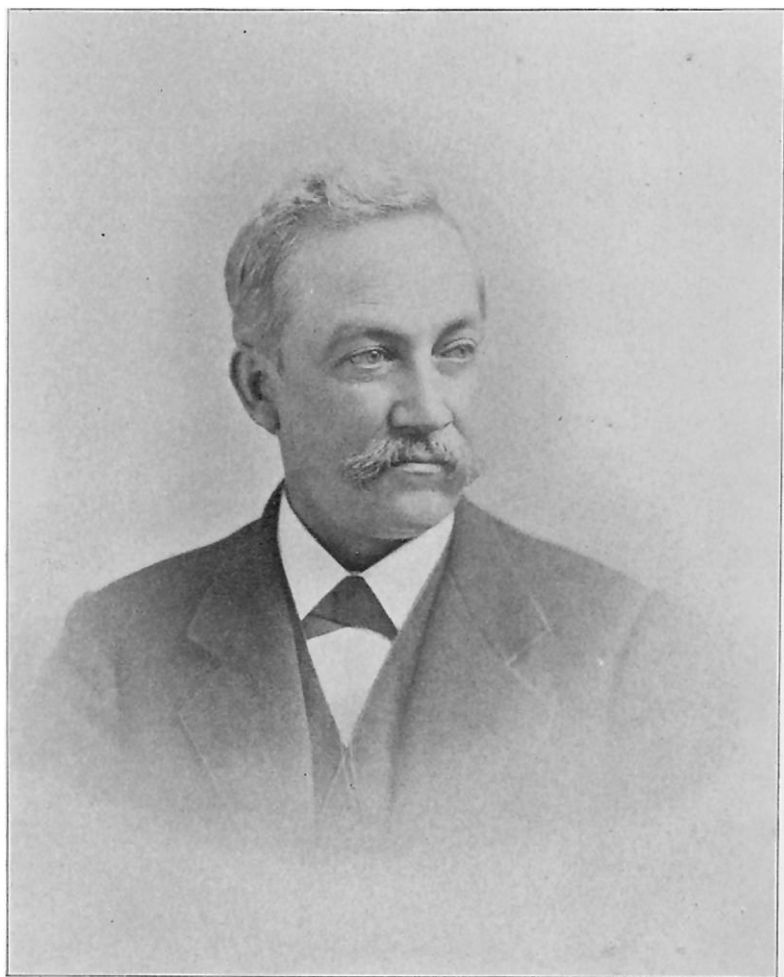
After a lingering and extremely sad illness he died in Philadelphia, Pa., on the 28th day of March, 1888.

How can we better do in this meagre sketch than repeat the words of the resolution passed by those nearest and dearest to him in his daily work, his workmen for the last quarter of a century.

*Resolved*, That we give public expression to our regard for the memory of the late Joseph Zentmayer, as a man whose benevolence, good nature, modesty and friendly disposition endeared him to us through many years of social intimacy; as a workman whose originality, thorough practical skill and energy has made his name known throughout the scientific world; as an employer whose sense of justice and equity equaled his superior natural abilities; as a friend upon whose judicious counsel we could always rely; and that, in our memories, he shall ever be an example of what constitutes a good man."

*Justum et tenacem propositi virum.*





JOSEPH ZENTMAYER.